# Milk Sucking Pump

The invention relates to a breast pump with an attachment, which is or can be releasably applied to the opening of a container and has a breast attachment element, and with a manual pump unit, which is releasably connected to the attachment by means of a connecting sleeve or a connecting bore, which has a cap-shaped connecting section, as well as a pump piston, which can be moved back and forth in a stroke chamber by means of an actuating handle, which is pivotable and provided with a retracting mechanism.

Such a breast pump with a manual pump unit is disclosed in DE 87 14 995 U1. With this known breast pump, an attachment with a funnel-shaped breast attachment element and with a pump connector is releasably screwed to a container. A cap-shaped section of the manual pump unit is placed on the pump connecting element. A pump cylinder with a pump piston guided in its interior is attached, horizontally projecting to the rear, to the cap-like section. The pump piston is moved back and forth with the aid of a lever-shaped actuating handle wherein, for returning the pump piston, the handle is supported by means of a U-shaped spring on a support fastened underneath the pump cylinder which extends as far as the underside of the container. The construction of the manual pump unit is relatively bulky and cumbersome, so that disadvantages can also result in the course of manipulating it.

In connection with another breast pump represented in EP 0 330 845 A2, a manual pump unit has a manual actuating element, which axially extends out of the pump cylinder toward the rear and is moved by one hand in the axial direction, while the breast pump is held with other hand. Thus, both hands are required for manipulation.

A pump cylinder of a breast pump shown in EP 0 385 933 A2 is oriented obliquely upward. A pump piston, which is guided in its interior, is actuated by means of two actuating elements, which are conducted laterally along the pump cylinder, and by a transverse strip, which is hingedly fastened on the actuating elements above the pump cylinder and moves upward when the actuating element is pressed together at the center, and downward, when it is released, in order to move the pump piston back and forth. The actuating unit with the pump piston can be replaced by an electrical pump, which is connected by means of a cover, which can be placed on the top of the pump cylinder.



The object of the invention is based on making available a breast pump of the type mentioned at the outset, which provides improved manipulation along with a simplified construction.

This object is attained by means of the characteristics of claim 1. In accordance therewith it is provided that the cap-shaped connecting section and the stroke chamber are combined in a mutual cap element, which is fixed on the attachment by retaining

means, and that the retracting mechanism, one side of which acts on the actuating handle, is seated with the other side on the cap element.

Simple cleaning and manipulation are assisted in that, in the completely inserted state of the pump piston, a stroke chamber opening on the side of the stroke chamber facing away from the breast connection element is covered by an upper section of the actuating handle which, in the position of use, is located above a pivot axis.

An easy movement of the piston and the connected actuation elements, which is free of wear to a considerable extent over time, is achieved in that the stroke chamber in the cap element is curved in an arc-shape in accordance with a movement path of the pump piston, which is actuated by the upper section of the actuating handle.

The entry of air into the piston chamber and the pumping effect are aided in that, with the container attached, a pivot path of the upper section of the actuating handle in the area of its connection to the pump piston has been selected to be so large that, in the moved-out state, at least an upper edge section of the pump piston is outside of an upper opening edge of the stroke chamber opening. In a similar manner it would be possible to cut, for example, a groove, or a bore, or the like, into the piston wall.

A simple, well functioning retracting mechanism is created and cleaning is made easier by means of the steps, wherein the retracting mechanism has at least one tension spring, and that a suspension element is positioned on the actuating handle, and a further suspension element on the cap element, in such a way, that with the piston in the inserted position, the direction of the tensile force lies above the pivot axis of the actuating handle, at least until, with the container attached, the actuating handle reaches its maximum pivot angle in the retraction direction of the pump piston, and that with the container removed and with a further increased pivot angle the direction of the tensile force lies below the pivot axis, so that the actuating handle is kept in the opened position in relation to the cap element.

An alternative embodiment of a well functioning, simple retracting mechanism consists in that the retracting mechanism has at least one pressure spring, that a support element on the inside of the actuating handle and a support section at the cap element are positioned in such a way that, at least with the piston rod inserted, the direction of the force of pressure lies below the pivot axis of the actuating handle. A rubber block, a spiral spring or a spiral spring, for example, can be employed here.

A restoring force which remains stable over time is achieved here with simple means in that the pressure spring is embodied as a spiral spring, whose front suspension lug is suspended and

retained in a support section of a free end section of the retaining element, which is oriented downward when in use, arcs upward in a U-shape in an interior chamber of the cap element and the grip and is supported with a free end section bent off from the suspension lug on a support element arranged on the inside of the actuating handle. In this case the support section and the support element can be formed on the retaining element, or the actuating handle. The spiral spring, which for example is made of steel, is thermally stable and can be cleaned by being boiled. It can be simply mounted and can be easily housed so it is invisible.

The manual pump unit can be easily replaced by an electric pump in that an electric pump can be directly connected by means of a hose to the connecting sleeve arranged on the attachment or to the connecting bore.

Simple sealing, which aids a good pumping effect, is achieved in that the connecting point between the connecting sleeve or the connecting bore and the cap element is sealed by means of conical connection or of a seal ring.

During electrical operation, if the electric pump does not have automatic ventilation, ventilation can be manually regulated by means of the steps that an opening is provided on the attachment in the area of the connecting sleeve or the connection bore, which can be closed by means of a stopper or, when the stopper has been removed, by hand.

A simple, releasable coupling between the attachment and the manual pump unit is achieved in that the retaining means have a snap-in element which snaps together with the attachment, when the cap element has been coupled to the attachment. Design and operation are in this case made easier by the steps in that the snap-in element is embodied as a snap-in tongue, which is oriented toward the container with a free end section and which, in the attached state, extends with a snap-in section behind an edge of the attachment facing toward the container when the cap element, located opposite the snap-in tongue, has been pushed on the connecting sleeve or the connecting bore, which are oriented axis-parallel in relation to the container.

Operation is furthermore made easier in that on its interior the cap element has retaining flaps or ribs on both sides, which constitute guide elements when it is placed on the attachment and securing elements against twisting of the cap element in relation to the attachment.

The fact that seating elements are arranged on both lateral sections of the cap element on the one hand and, on the other hand on both lateral sections of the actuating handle which, in the form of separable bearing pin/bearing eye connection, constitute the pivot axis between the actuating handle and the cap element, adds to the simple construction and simple operation.

A shape of the manual pump unit which is advantageous in respect to cleaning and handling, consists in that in the rear area remote from the breast attachment element the cap element has a rounded top which, in the pivoted-in state of the upper section of the actuating handle, makes a steady transition into the also curved exterior of the latter.

The operation of the manual pump is made easier in that in cross section the upper section and the lower section are outwardly rounded on their rear facing away from the breast attachment element and make a steady transition into each other, wherein an obtuse angle, open toward the rear, is formed between the upper section and the lower section.

A simple change of the pump output is achieved in that an intermediate piece is provided, which can be inserted into a V-shaped gap which, when the actuating handle is pivoted, is formed in the upper area between the upper section of the latter and the edge of the stroke chamber opening, and by means of which the stroke travel of the pump piston can be preset to be continuous or stepped.

By means of the steps that spacer cams, which come into contact with the upper edge of the container in the attached state, are provided on the inside of a screw connector of the attachment for connecting it with the container, so that an air exchange with the atmosphere is provided in the attached state, it is achieved

that the ventilation of the container is assured when the attachment has been screwed on the container.

To attach the pump piston in a simple manner, the means are advantageous that the pump piston has a piston rod formed on it centered or eccentric, on whose backward oriented end section a releasable hinged connection with the upper section of the actuating handle is provided.

If it is provided that a protrusion made of a soft material is arranged on the interior, on the container side, of the lower section of the actuating handle for forming a stop between the actuating handle and the container, the hard contact of the actuating handle with the container wall is prevented. Here, the stop can also be designed for changing the pivot path for actuating the pump piston.

Moreover, the steps add to good handling, that the manual pump unit and the attachment are arranged in such a way, and their weight is compensated, that in the empty state and with the attachment placed on it and the manual pump unit attached, the container remains upright.

The interior of the breast pump can be variably ventilated by means of the steps that a secondary air regulating unit, which can be operated manually from the outside, is provided on the cap element for ventilating the suction chamber, which varies during the pump operation.

Here, a simple construction along with easy manipulation consists in that the secondary air regulating unit is provided with a rotatable insert and/or attachment arranged on the exterior of the cap element, by means of whose rotation a flow-through conduit, which leads through a wall in the cap element into the stroke chamber, is opened to a greater or lesser extent, or can be completely closed. In this case the setting preferably is continuous and can be reproduced, for example, by means of markings which can be felt. A vacuum is automatically reduced when the flow-through conduit is open, and the degree of the vacuum can be individually selected. It is advantageous for health care reasons, if it is produced from silicon.

The invention will be explained in greater detail by means of an exemplary embodiment, making reference to the drawings. Shown are in:

Figs. 1A to 1E, views of a breast pump with a container from the front, from the rear, from above, or in a perspective representation,

Figs. 2A to 2E, a manual pump unit employed with the breast pump in a lateral view, from the rear, from the front, from above, or in a perspective representation,

Figs. 3A to 3F, an actuating handle employed with the breast pump from the front, from the right side, from the left side, from the rear, from below, or from above,

Figs. 4A to 4E, a cap element employed with the breast pump from the side, from the rear, from the front, from below, from above, or in a perspective view,

Figs. 5A to 5E, a pump piston employed with the breast pump in a perspective view, from above, from the side, from the rear, or from the front,

Figs. 6A to 6E, a further manual pump unit, in which a different retracting mechanism and a secondary air regulating unit are provided in contrast to the previous exemplary embodiments, and

Figs. 7A and 7B, a cross section through the manual pump unit in accordance with Figs. 6A, 6D and 6E in a view from below, or in a detailed view x.

As can be seen in Fig. 1, the breast pump 1 has a container 2 for receiving the pumped out milk, an attachment 6 screwed on it, a manual pump unit 3 releasably attached to the latter, consisting of an actuating handle 4 and a cap element 5, releasably connected with the latter.

The attachment 6 is screwed by means of a screw connector 6.2 to a collar section of the container 2, which surrounds the container opening. A breast attachment element 6.1 is connected in a manner known per se to a cover section of the screw connector 6.2, wherein a flow-through valve is arranged approximately in the area of the cover element, through which the pumped milk reaches the container 2 and can be prevented from leaving the container 2,

or cannot be aspirated back.

On the attachment 6, the manual pump unit 3 with the cap element 5 has been tightly placed on a connecting element in the form of a sleeve which projects upward parallel with the container axis and has an appropriately matched coupling element 5.3, which is sealed, for example, by means of a cone seal or an additional sealing element and is represented in Figs. 2C, 4C and 4D. The coupling element 5.3 is formed on the inside of the upper wall of the cap element 5, extending downward, and makes a transition into a connecting conduit 5.7, which terminates in a stroke chamber also formed in the cap element 5, as shown in Fig. 4B. A retaining element 5.1 in the form of a snap-in tongue projects from the underside of the cap element 5, which snaps into a snap- in shoulder at the lower edge of the screw connector 5.2, wherein the snap-in tongue is displaced against its spring force by means of a snap-in ramp at the end, when the cap element 5 is attached.

The stroke chamber 5.2 is arranged in the rear section of the cap element 5 facing away from the attachment element 6.1 and has a stroke chamber opening 5.4 on its rear, while it is closed off toward the front by means of a front face 5.9. The stroke chamber 5.2 is designed to be curved in accordance with the movement path of a pump piston 7, which is moved back and forth in it by means of the actuating handle 4. Retaining flaps, or retaining strips 5.5 of a retaining element which is U-shaped in

cross section, are provided on the underside of the cap element 5 at the side, and have in their lower area near the free end bearing eyes 5.6 for the insertion of correspondingly designed bearing pins 4.4 of the actuating handle 4 in order to make a releasable, hinged connection of the actuating handle 4 on the cap element 5. Moreover, strips, which extend essentially parallel with the container axis, have been formed on both sides of the interior of the front section of the cap element 5, as well as suspension elements 5.8, in which retracting springs 8, for example rubber rings, are suspended, in order to bring, by means of a spring force, the actuating handle 4 attached to the cap element 5 after its deflection back into the initial position, in which the pump piston 7 is introduced into the stroke chamber 5.2, as can be seen in Fig. 2A. Corresponding further suspension elements 4.3 are attached to strips 4.5 on the inside of the actuating handle 4. The strips 4.5 also support the bearing pins 4.4, as can be seen in Figs. 2C, 3A, 3E and 3F.

With its upper section 4.1, which is located above the hinge axis, the actuating handle 4 makes a steadily curving transition at the top and the sides into the curves of the cap element 5 and, in the completely inserted position of the pump piston 7, it closes the stroke chamber 5.4, as shown in Figs. 1A and 2A. A lower section 4.2, oriented backward at an obtuse angle, which in cross section is also convexly curved outward, follows the upper section

4.1 of the actuating handle 4 approximately in the area of the pivot axis, so that satisfactory manipulation of the lower handle section 4.2 for performing a pumping operation results, wherein the lower section 4.2 rests against the ball of the thumb, and wherein in the transition area between the upper section 4.1 and the lower section 4.2, the thumb and index finger, pointing forward, can grasp the upper container section. A connecting element 4.6 is formed on the inside of the upper section 4.1 for providing a connection with a piston rod 4.3 of the pump piston 7. As can be seen in Figs. 5A to 5D, the piston rod 4.3 is formed on a retainer plate 7.2, which itself constitutes a part of a piston plate 7.1 with lateral sealing edges. A soft spacer element, not further represented, can be provided on the inside in the lower section 4.2 of the actuating handle, so that during actuation the lower section 4.2 gently touches the outside of the container 2, and so that also a limitation of the stroke travel of the pump piston 7 can be set by means of this. Moreover, an intermediate piece, also not represented, can be provided for limiting the stroke travel and therefore the pumping effect which, during the pivoting out of the upper section 4.1 of the actuating handle 4, can be inserted between the edge of the stroke chamber opening 5.4 and the upper section 4.1. An opening, which can be selectively released and can be closed by means of a stopper, can be provided on the back of the attachment 2 for manual ventilation when an electric pump is

attached to the conecting sleeve.

Figs. 6A to 6E and 7A, 7B show a further exemplary embodiment of the breast pump 1, wherein the manual pump unit 3 is provided with a secondary air regulating unit 9 and with a retracting mechanism 8', which is an alternative to the previous exemplary embodiments. Otherwise the design essentially corresponds to that of the previous embodiment, wherein the reference numerals relate to corresponding parts of the breast pump 1.

The retracting mechanism represented in Figs. 6A and 6C has a spiral spring 8', which is essentially bent into a U-shape, wherein the end of the one, front leg is angled off to form a suspension lug, while the other leg terminates in an outwardly bent end section. The suspension lug is fixed in a cutout formed in the lower (in the position of use) end section of the retaining element 5.1 in the shape of a support section 5.11, which was formed during the manufacturing process, while the other leg end is inserted and supported in a support element 4.7 formed on the inside of the actuating handle 4. With these steps, the spiral spring can be easily mounted and removed, for example in the course of disassembling the cap element 5 and the actuating handle 4. The spiral spring is preferably embodied as a steel spring and maintains its spring properties permanently and can also be cleaned without problems by boiling. In the installed state it projects

with the U-shaped arch upward into a hollow space formed between the cap element 5 and the actuating handle 4, so that it is housed in an invisible manner.

As can be seen from Figs. 6A, 6B, 6E, 6D and 7B, 7A, the secondary air regulating unit 9 is arranged laterally on the exterior of the wall of the cap element 5. It has an inlet section 9.1, which is formed in the cap element 5 and slightly projects outward, in which a central receiving pin for an insert 9.2, which can be attached from the outside, as well as a flow- through conduit 9.11, which terminates in the stroke chamber 5.2 in the vicinity of the front wall 5.9, are provided, as can be seen in Figs. 7A and 7B. An opening 9.21 is formed in the insert 9.2, which has been aligned or can be aligned with the flow- through conduit 9.11. The inlet section 9.1 and the insert 9.2 are covered by a removable cover 9.3, preferably made of silicon, wherein a slot 9.31 can be more or less aligned with the opening 9.21. The opening 9.21 terminates in a laterally widened section, so that the amount of the covering of the conduit leading outward from the stroke chamber 5.2 can be easily varied within a wide range by an appropriate rotation of the cover 9.3. For simple actuation, the cover 9.3 has grip elements, which project rib-like from the circumference, one of which is thickened for marking a position of rotation. As can be seen in Fig. 7B in particular, a lip-like edge of the cover 9.3 extends below an outward projecting

circumferential collar of the inlet section 9.1, so that satisfactory retention and satisfactory sealing of the cover 9.3 result.

The secondary air regulation unit 9 provides a continuous, reproducible regulating possibility for air conducted into the suction chamber of the breast pump. A built-up vacuum is automatically reduced by means of the secondary air opening being opened to a greater or lesser extent, and the size of the vacuum can be individually selected. Automatically intermittent pumping can be performed.